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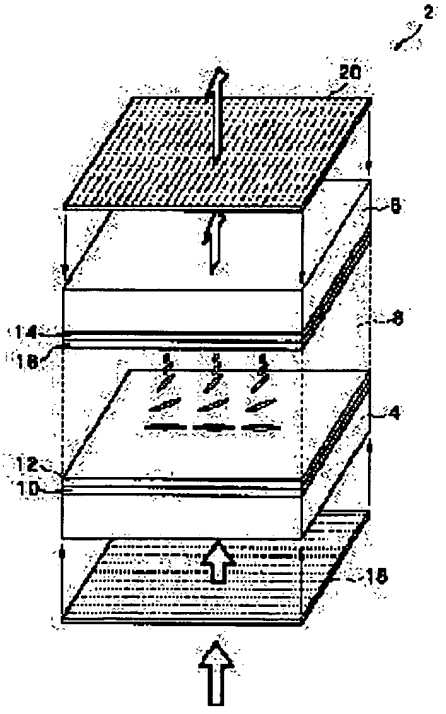
(54) METHOD OF CORRECTING DEFECTIVE PIXEL OF LIQUID CRYSTAL DISPLAY AND DEFECTIVE PIXEL CORRECTION DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To make a defective pixel inconspicuous by emitting laser light on the defective pixel and correcting optical transmittance, etc., with good controllability.

SOLUTION: Orientation films 12, 16 arranging orientational direction of liquid crystal molecules are irradiated with laser light for degrading an orientation performance and are corrected in emitting light quantity from defective pixels. This arrangement permits to arbitrarily fix an optical transmittance, etc., of the defective pixels for making them inconspicuous. To obtain a good controllability, this correction is recommended to be performed before polarizes 18, 20 are placed. Also, it preferably improves the controllability if the correction is repeated until reaching a target transmittance (for example, rather black side than a middle value of black and white), while monitoring the optical transmittance. Further, if the irradiation with the laser light is focused in the beam radius and is repeated plural times by shifting the emitting position within the defective picture element, it makes the laser radiation stable and reduces emitting energy for each time, and improves the controllability further.



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CLAIMS

[Claim(s)]
[Claim 1] The defect pixel amendment approach of the liquid crystal display which it is the defect pixel amendment approach of a liquid crystal display of having the orientation film which arranges the direction of orientation of a liquid crystal molecule, and laser light is irradiated at the defect pixel part, and an orientation function is reduced to said orientation film, and amends the outgoing radiation quantity of light to the amount of predetermined incident light of a defect pixel.
[Claim 2] On the other hand, said orientation film is formed in a field side, and said liquid crystal display has two substrates with which the polarizing plate which makes only the light of the predetermined direction penetrate has been arranged at the another side side side. The exposure of said laser light The defect pixel amendment approach of the liquid crystal display according to claim 1 performed before arranging said polarizing plate to the another side side side of each substrate after [which opposed the field side mutually on the other hand, and said two substrates were made to counter, and enclosed liquid crystal with the gap] the orientation film is formed.
[Claim 3] The defect pixel amendment approach of a liquid crystal display according to claim 1 of setting up the exposure conditions of laser light so that the light transmittance of said defect pixel may be measured beforehand and predetermined light transmittance may be obtained in advance of the exposure of said laser light based on this measurement result.
[Claim 4] The defect pixel amendment approach of a liquid crystal display according to claim 3 of measuring the light transmittance of said defect pixel, and performing laser light exposure and measurement of light transmittance for the second time again after the exposure of said laser light repeatedly until predetermined light transmittance is obtained.
[Claim 5] The defect pixel amendment approach of the liquid crystal display according to claim 3 which irradiates multiple times and laser light while shifting a location within said defect pixel on the occasion of the exposure of said laser light based on the result of said light transmittance measurement before this.
[Claim 6] Said predetermined light transmittance is the defect pixel amendment approach of the liquid crystal display according to claim 3 set to a black display side from a mean value with that of the light transmittance at the time of the black display of a normal pixel, and the light transmittance at the time of a white display.
[Claim 7] The light source which applies light to the defect pixel to the liquid crystal display which has the orientation film which arranges the direction of orientation of a liquid crystal molecule, A light-receiving means to receive the outgoing radiation light from a defect pixel which received the light from the light source, A measurement means to measure the outgoing radiation quantity of light to the amount of predetermined incident light of a defect pixel based on the light income of a light-receiving means, The defect pixel compensator of the liquid crystal display which has the control means which sets up the exposure conditions of laser so that the light of said predetermined outgoing radiation quantity of light may be outputted from a defect pixel, and a laser radiation means to irradiate laser light and to reduce an orientation function on the orientation film of a defect pixel based on said exposure conditions.

[Claim 8] the inside of said defect pixel -- the exposure location of laser light -- specified quantity ****** -- a variation rate -- a means -- further -- having -- said exposure conditions -- the variation rate concerned -- the variation rate of the exposure location of the laser light by the means -- an amount and a variation rate -- a direction and a variation rate -- the defect pixel compensator of the liquid crystal display according to claim 7 with which a count is contained.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] For the improvement in the product yield, this invention irradiates laser light at a defect pixel, amends light transmittance etc., and relates to the defect pixel amendment approach and defect pixel compensator of a liquid crystal display which are not conspicuous and carry out a defect pixel.
[0002]
[Description of the Prior Art] For example, as for a rear projector or the various liquid crystal displays (liquid crystal panel) as a direct viewing type display, hundreds of thousands - millions of pixels are also integrated on the same panel. Therefore, if a component defect and a circuit pattern defect occur in the switching element (for example, a thin film transistor and MIM (Metal Insulator Metal) diode) of each pixel, this will appear as a defect of a screen and will reduce the product yield.
[0003] As a cure in this case, by LCD (Liquid Crystal Display) of the conventional, for example, active matrix, method, two or more switching elements have been beforehand arranged for every pixel, the switching element which started the malfunction in the defect pixel was separated by laser light exposure, and there was the trimming approach of the redundancy circuit system of reviving a product.
[0004]
[Problem(s) to be Solved by the Invention] However, by the trimming approach of this conventional redundancy circuit system, in order to separate an excessive switching element and this excessive, redundancy wiring which irradiates laser light was needed, and the technical problem that pixel area was increased for this reason and high integration could not be attained occurred.
[0005] Moreover, depending on the magnitude of a defect, a location, and the number, the pixel might be unreproducible. For example, when a defect was based on dust, there was a case where this dispersed by laser light exposure depending on the magnitude of dust, and a defective field like silverfish spread on a screen. Moreover, in the case where all the switching elements in 1 pixel start a malfunction, playback has already been impossible. Furthermore, also when playback of a pixel was not completed by separating a switching element depending on the location of a defect, it was.
[0006] This invention is made in view of such the actual condition, irradiates laser light at a defect pixel, amends light transmittance etc. with a sufficient controllability, and aims at offering the defect pixel amendment approach and defect pixel compensator of a liquid crystal display which are not conspicuous and carry out a defect pixel.
[0007]
[Means for Solving the Problem] In order to solve the trouble of the conventional technique mentioned above and to attain the above-mentioned purpose, it is the defect pixel amendment approach of a liquid crystal display of having the orientation film which arranges the direction of orientation of a liquid-crystal molecule, and to said orientation film, laser light is irradiated at the defect pixel part, an orientation function is reduced, and it is characterized by the defect pixel amendment approach of the liquid crystal display of this invention by to amend the outgoing-radiation quantity of light to the

amount of predetermined incident light of a defect pixel. Thereby, the light transmittance of a defect pixel is fixable to arbitration within the change width of face of the light transmittance of a surrounding normal pixel, it cannot be conspicuous and a defect pixel can be carried out.

[0008] In order to amend light transmittance with a sufficient controllability, it is good to perform this amendment before arrangement of a polarizing plate. Namely, on the other hand, as for said liquid crystal display, said orientation film is formed in a field side in this case. It has two substrates with which the polarizing plate which makes only the light of the predetermined direction penetrate has been arranged at the another side side side. The exposure of said laser light On the other hand, oppose a field side mutually, and said two substrates are made to counter, and after [which enclosed liquid crystal with the gap] the orientation film is formed, it is characterized [other] by carrying out, before arranging said polarizing plate to the another side side side of each substrate.

[0009] Moreover, a controllability rises and is more desirable [an exposure], when a laser beam exposure repeats light transmittance measurement and a laser light exposure and they are performed until it performs it, carrying out the monitor of the light transmittance and it reaches predetermined target light transmittance. Although the exposure of laser light may change the energy density and beam diameter of a laser beam, since laser radiation is stable and 1 time of exposure energy is also small when multiple times and laser light are irradiated extracting a beam diameter and shifting an exposure location within a defect pixel part, the further improvement in a controllability is possible for it. Moreover, since the control should just shift a relative position, it is easy in comparison.

[0010] Predetermined light transmittance is better than a mean value with that of the light transmittance at the time of the black display of a normal pixel, and the light transmittance at the time of a white display to set to a black display side. It is because a defect pixel is not conspicuous as a whole and is desirable in this semantics, when the light transmittance of a defect pixel is amended to the black side, since the luminescent-spot defect pixel with light transmittance high 1 pixel is conspicuous from that reverse ******** pixel while the perimeter is indicating by black.

[0011] On the other hand, in the defect pixel compensator of the liquid crystal display of this invention The light source which applies light to the defect pixel to the liquid crystal display which has the orientation film which arranges the direction of orientation of a liquid crystal molecule, A light-receiving means to receive the outgoing radiation light from a defect pixel which received the light from the light source, A measurement means to measure the outgoing radiation quantity of light to the amount of predetermined incident light of a defect pixel based on the light income of a light-receiving means, It is characterized by having the control means which sets up the exposure conditions of laser so that the light of said predetermined outgoing radiation quantity of light may be outputted from a defect pixel, and a laser radiation means to irradiate laser light and to reduce an orientation function on the orientation film of a defect pixel based on said exposure conditions. moreover, the inside of said defect pixel -- the exposure location of laser light -- specified quantity ****** -- a variation rate -- a means can also be made to provide further in this case -- said exposure conditions -- the variation rate concerned -- the variation rate of the exposure location of the laser light by the means -- an amount and a variation rate -- a direction and a variation rate -- a count is contained.

[0012]

[Embodiment of the Invention] In advance of explanation of the pixel compensator of the liquid crystal display concerning this invention, and the pixel amendment approach, the configuration of the liquid crystal display with which this invention is applied is explained hereafter, referring to a drawing. The liquid crystal display (liquid crystal panel) with which this invention is applied can be carried out especially suitable for matrix means of displaying with many pixels, although there is especially no limitation. ** whose drive method is also an active-matrix drive method as it is a simple matrix drive method is not asked. Moreover, reliance is also good at any of a reflective mold and a transparency mold.

[0013] Hereafter, the case where a driver element is a thin film transistor (TFT;Thin Film Transistor) is explained to an example as an example of an active-matrix drive method. The rough configuration of a liquid crystal panel is shown in drawing 1 and 2, drawing 1 is structural drawing of the 1-pixel part of a

liquid crystal panel, and drawing 2 is a representative circuit schematic. As shown in drawing 1 , in this liquid crystal panel 2, generally, two substrates 4 and 6 are made to counter, liquid crystal is enclosed with that gap, and the liquid crystal layer 8 is formed.

[0014] As these two substrates, although single crystal silicon is sufficient in reflective molds, such as a MOS-FET mold, in order to make the light from a back light penetrate, the quartz-glass substrate with a thickness of about 0.8-1.1mm etc. is used in this TFT mold. Here, the substrate 4 of the drawing bottom (back light side) is called a drive substrate, and the substrate 6 of a drawing top (panel front-face side) is called an opposite substrate.

[0015] The signal line S1 with which a picture signal is impressed to the liquid crystal side front face of the drive substrate 4 as shown in drawing 2 , and S2 -- and Sn, The gate line G1 by which a scan signal is impressed, and G2, --, Gm are arranged in the shape of a matrix, and the thin film transistor (it is written as "Trij" the nMOS transistors Tr11, Tr12, Tr21, and Tr22, --, Trnm, and the following) is prepared near [each] the intersection. For each nMOS transistor Trij, the gate is connected for any of the gate line G1, and G2, --, Gm being, and one impurity diffused layer is a signal line S1 and S2. It connects with any of -- and Sn.

[0016] On this nMOS transistor Trij, the transparent pixel electrode 10 divided for every pixel as shown in drawing 1 is formed, and the orientation film 12 for arranging the direction of molecular arrangement of the liquid crystal layer 8 is formed on it. The pixel electrode 10 consists of transparent electric conduction film, such as ITO (Indium Tin Oxide). Although there is no limitation in the thickness, it is about 140nm, for example. As orientation film 12, although the inorganic film is sufficient, organic film, such as polyimide film which has about dozens of nm thickness, is usually used. On the other hand, as for the front face of the orientation film 12, rubbing processing is performed to the direction (drawing longitudinal direction).

[0017] On the other hand, although not illustrated especially in the liquid crystal side front face by the side of the opposite substrate 6, a black stripe is arranged on both sides and a color filter is formed, and as shown in drawing 1 , the transparent common electrode 14 which consists of ITO film etc. is formed, and it is covered with the liquid crystal side face by the orientation film 16. Although rubbing processing is performed also for the front face of this orientation film 16, that direction lies at right angles 90 degrees in the orientation film 12 by the side of the drive substrate 4. Thereby, the condition that the direction of molecular arrangement was twisted 90 degrees in the thickness direction is prepared like illustration in the liquid crystal layer 8. In addition, the thickness of the liquid crystal layer 8 is about several micrometers.

[0018] The capacitor is constituted on both sides of the liquid crystal layer 8 by the common electrode 14 and the above mentioned pixel electrode 10. On the equal circuit of drawing 2 , Capacitors C11, C12, C21, C22, --, Cnm and liquid crystal are connected to juxtaposition at one impurity diffused layer of each nMOS transistor Trij, respectively. The common electrode 14 is the common potential Vcom. It is held.

[0019] Polarizing plates 18 and 20 are stuck on the lateral surface of the drive substrate 4 and the opposite substrate 6, respectively. Each polarizing plates 18 and 20 are arranged after the light absorption shaft has intersected perpendicularly mutually.

[0020] If back light light is applied to the liquid crystal panel 2 of such a configuration from the outside of the drive substrate 4, on the other hand, the light will polarize in a direction through a polarizing plate 18, will penetrate the drive substrate 4 and the pixel electrode 10 further, and will carry out incidence to the liquid crystal layer 8. While light penetrates the inside of the liquid crystal layer 8, the polarization direction of the transmitted light meets in the direction of molecular arrangement of liquid crystal according to the effectiveness of the optical anisotropy of a liquid crystal molecule, it changes 90 degrees, the common electrode 14 and the opposite substrate 6 are passed, and incidence is carried out to a polarizing plate 20. Since said polarizing plate 18 and polarization direction which light penetrated first lie at right angles 90 degrees as this polarizing plate 20 was described above, as for the light which carried out incidence to the polarizing plate 20, in accordance with the polarization direction of a polarizing plate 20, outgoing radiation of most is carried out for that polarization direction to a panel

front-face side. Therefore, a pixel front face is checked by looking by back light light as a bright condition, and a white display is made.

[0021] At the time of the above white display, the electrical potential difference is not impressed between the pixel electrode 12 and the common electrode 14. On the other hand, the direction of molecular arrangement of the liquid crystal layer 8 will come to be equal to a lengthwise direction according to that applied voltage, if an electrical potential difference is impressed to these two electrodes 12 and 14 gradually in accordance with electric field. Drawing 3 shows the case where an electrical potential difference is fully made high. In this case, since the polarization direction of the light which passes through the inside of the liquid crystal layer 8 hardly changes, to a panel front-face side, light hardly penetrates, but it is checked by looking as a condition dark in a pixel front face, and a black display is made.

[0022] Drawing 4 shows the permeability property which light transmittance decreases with the increment in driver voltage. As shown also in this property Fig., by adjusting applied voltage in such a liquid crystal panel 2, middle gradation of the above-mentioned white display and a black display can be realized, and color display is possible according to a non-illustrated color filter. This voltage adjustment is a signal line S1 and S2, in case each gate line G1, and G2, --, Gm are chosen in drawing 2 according to a scan signal. --, and potential and common potential Vcom of a picture signal which were impressed to Sn It is decided by the potential difference (driver voltage).

[0023] The case where the liquid crystal panel 2 mentioned above is used next about the defect pixel compensator and the defect pixel amendment approach of this invention is explained to a detail, referring to a drawing for an example. This invention amends the light transmittance of a defect pixel etc. by reducing the orientation function of the orientation film 12 and 16 of drawing 1 .

[0024] First, the defect pixel is explained briefly. Drawing 5 is drawing showing typically the drive substrate 4 above child in whom the pixel electrode 10 was formed, and makes the A section of drawing 2 repeat and arrange. In the manufacture process of a liquid crystal panel 2, a defect pixel may occur according to dust, a mask pattern defect, etc. As Sign B shows drawing 5 to one of the failure mode of this, the wiring layer between the pixel electrode 10 and the nMOS transistor Trij (or wiring layer between signal lines Si and Trij) may go out (henceforth pattern defect B). Moreover, it may remain wide opened as other failure modes, while abnormalities are in the nMOS transistor Trij itself and the channel had short-circuited as Sign C shows to this drawing (henceforth a transistor defect).

[0025] A defect pixel with it is called especially a luminescent-spot defect pixel, without building an electrical potential difference over failure mode of abbreviation being in a circumference pixel by carrying out in a pattern open circuit, channel disconnection of a transistor, etc., and the predetermined electrical potential difference being impressed only there. [high light transmittance and] [bright] Moreover, an electrical potential difference is built over the electrical potential difference not being impressed to a circumference pixel for failure mode in a channel short circuit etc. only there, and a defect pixel with it is called especially a ******** pixel. [low light transmittance and] [dark]

[0026] Among these, since the luminescent-spot defect pixel in the inside as for which the perimeter is indicating by black is conspicuous from the ******** pixel in the inside currently white-displayed, below, this invention is explained to an example for the case of a luminescent-spot defect pixel. Drawing 6 is the outline block diagram of the defect pixel compensator of this invention. This defect pixel compensator 30 consists of the camera 36 which changes into an electrical signal the image of the microscope 34 for extracting the beam of the laser head 32 which generates laser light, and laser light, and observing a liquid crystal panel 2, and a microscope 34, a xy stage 38 which supports and carries out alignment of the liquid crystal panel 2, an image processing system 42 which measures the light transmittance of the 40 pixel back light light source, and a controller 44 which controls laser head 32 grade based on light transmittance.

[0027] Below, the concrete procedure of defective amendment is explained along with the flow chart of drawing 7 . First, the liquid crystal panel 2 as a candidate for defective amendment is put on the xy stage 38, and the address of the defect pixel of a liquid crystal panel 2 is inputted into a controller 44 (ST1). A manual entry is sufficient as this address input, and you may make it incorporate a controller 44

automatically from the test equipment whose address is not illustrated.

[0028] According to the address of the inputted defect pixel, a controller 44 controls the xy stage 38 and moves a defect pixel into the visual field of a camera 36 (ST2). And the back light light source 40 is turned on with directions of a controller 44, the amount of transmitted lights is changed into an electrical signal through a camera 36, and after measuring the light transmittance of a defect pixel with an image processing system 42 based on the amount of transmitted lights which this electrical signal shows, the optimal exposure conditions are computed and set up by the controller 44 based on a measurement result (ST3).

[0029] These optimal exposure conditions differ by into how much light transmittance of a defect pixel is made. Although the predetermined light transmittance made into this target may be set as what kind of value within the change width of face of a normal pixel, it is better than a mean value with the time of the black display of a normal pixel, and a white display preferably to set to a black display side. It is because a defect will stop being able to be conspicuous easily as a whole if the light transmittance of a defect pixel is amended to the black side since the luminescent-spot defect pixel with light transmittance high 1 pixel is conspicuous from the reverse ******** pixel while the perimeter is indicating by black as stated previously.

[0030] After adjusting so that a controller 44 may control the optical system of a microscope 34 and a laser beam may become the orientation film 12 of a liquid crystal panel 2, or a beam diameter (or energy density) predetermined by 16 while a controller 44 adjusts the output of a laser head 32 according to the set-up exposure conditions, laser light is irradiated at a defect pixel (ST4). The exposure of this laser light is performed two or more times within the defect pixel with this operation gestalt, shifting an exposure location at a minute step, although predetermined target light transmittance may be once aimed at by exposure. In this case, the amount of displacement, the displacement direction, and the count of displacement of this minute step are contained in the exposure conditions which a controller 44 sets up by the above ST 3. Moreover, the controller 44 at this time controls a laser head 32 and a microscope 34, and also moves the xy stage 38 at a minute step.

[0031] Damage section 12a is introduced into the orientation film 12 by the exposure of this laser light, the orientation function of the orientation film 12 falls by this, and drawing 8 shows signs that the direction of orientation is disturbed. Moreover, drawing 9 is an explanatory view in which this invention persons show the situation of the cross section when actually introducing damage section 12a into the orientation film 12 using this invention. By drawing 9 , a hole opens on the orientation film 12, the orientation film 12 has been turned over to that perimeter, and the bottom of the exposure conditions in this example can be asked about signs that a liquid crystal molecule is perpendicularly located in a line along with this. Die length of one side of the pixel used for this example is about 50 micrometers, and since the outer diameter of the damage section by laser light exposure is about 2 micrometers, the light transmittance of a pixel is changeable at a quite fine step.

[0032] In ST5 of drawing 7 , the light transmittance of a defect pixel is again measured after the exposure of laser light, and it judges whether target light transmittance is attained by following ST6. When the failure mode of a defect pixel is the open circuit by the pattern defect, drawing 10 is before and after the exposure of laser light, and is the permeability property Fig. showing the situation of change of light transmittance. Since the light transmittance in this defect pixel does not require driver voltage, constant value is shown. When this value is made into 100%, light transmittance is reduced to 15% of desired value by laser light exposure.

[0033] When target light transmittance is attained by the judgment of ST6 of drawing 7 , the defective amendment concerned is completed. When this is not attained, a controller 44 computes exposure conditions again (ST7), returns a flow before ST4, and irradiates laser light again. ST4-ST7 are repeated until target light transmittance is attained.

[0034]

[Effect of the Invention] As explained above, according to the defect pixel amendment approach and defect pixel compensator concerning this invention, amendment of light transmittance etc. is easily made to the orientation film from irradiating laser light and reducing an orientation function rather than

it changes the optical property of other parts.
[0035] Moreover, if it carries out carrying out [before arranging a polarizing plate, perform this defective amendment, or] the monitor of the light transmittance, it cannot be conspicuous and a controllability can improve a defect pixel. Furthermore, if multiple times and laser light are irradiated shifting an exposure location within a defect pixel, the exposure energy whose stability of laser radiation is 1 time well will also have little effect (for example, optical property degradation etc.) on others [end / it is small and], and its controllability will improve more. As mentioned above, a defect pixel can also make it hard to be to set this as the optimal value by the side of a black display, and conspicuous [a setup of target light transmittance is also easy, and], since a controllability can improve by the approach of this invention.
[0036] As mentioned above, laser light can be irradiated at a defect pixel, light transmittance etc. can be amended with a sufficient controllability, and the defect pixel amendment approach and defect pixel compensator of a liquid crystal display which are not conspicuous and carry out a defect pixel can be offered. Thereby, this invention contributes to the improvement in the yield of a liquid crystal display, as a result low-pricing greatly.

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TECHNICAL FIELD

[Field of the Invention] For the improvement in the product yield, this invention irradiates laser light at a defect pixel, amends light transmittance etc., and relates to the defect pixel amendment approach and defect pixel compensator of a liquid crystal display which are not conspicuous and carry out a defect pixel.

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PRIOR ART

[Description of the Prior Art] For example, as for a rear projector or the various liquid crystal displays (liquid crystal panel) as a direct viewing type display, hundreds of thousands - millions of pixels are also integrated on the same panel. Therefore, if a component defect and a circuit pattern defect occur in the switching element (for example, a thin film transistor and MIM (Metal Insulator Metal) diode) of each pixel, this will appear as a defect of a screen and will reduce the product yield.
[0003] As a cure in this case, by LCD (Liquid Crystal Display) of the conventional, for example, active matrix, method, two or more switching elements have been beforehand arranged for every pixel, the switching element which started the malfunction in the defect pixel was separated by laser light exposure, and there was the trimming approach of the redundancy circuit system of reviving a product.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to the defect pixel amendment approach and defect pixel compensator concerning this invention, amendment of light transmittance etc. is easily made to the orientation film from irradiating laser light and reducing an orientation function rather than it changes the optical property of other parts.
[0035] Moreover, if it carries out carrying out [before arranging a polarizing plate, perform this defective amendment, or] the monitor of the light transmittance, it cannot be conspicuous and a controllability can improve a defect pixel. Furthermore, if multiple times and laser light are irradiated shifting an exposure location within a defect pixel, the exposure energy whose stability of laser radiation is 1 time well will also have little effect (for example, optical property degradation etc.) on others [end / it is small and], and its controllability will improve more. As mentioned above, a defect pixel can also make it hard to be to set this as the optimal value by the side of a black display, and conspicuous [a setup of target light transmittance is also easy, and], since a controllability can improve by the approach of this invention.
[0036] As mentioned above, laser light can be irradiated at a defect pixel, light transmittance etc. can be amended with a sufficient controllability, and the defect pixel amendment approach and defect pixel compensator of a liquid crystal display which are not conspicuous and carry out a defect pixel can be offered. Thereby, this invention contributes to the improvement in the yield of a liquid crystal display, as a result low-pricing greatly.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, by the trimming approach of this conventional redundancy circuit system, in order to separate an excessive switching element and this excessive, redundancy wiring which irradiates laser light was needed, and the technical problem that pixel area was increased for this reason and high integration could not be attained occurred.
[0005] Moreover, depending on the magnitude of a defect, a location, and the number, the pixel might be unreproducible. For example, when a defect was based on dust, there was a case where this dispersed by laser light exposure depending on the magnitude of dust, and a defective field like silverfish spread on a screen. Moreover, in the case where all the switching elements in 1 pixel start a malfunction, playback has already been impossible. Furthermore, also when playback of a pixel was not completed by separating a switching element depending on the location of a defect, it was.
[0006] This invention is made in view of such the actual condition, irradiates laser light at a defect pixel, amends light transmittance etc. with a sufficient controllability, and aims at offering the defect pixel amendment approach and defect pixel compensator of a liquid crystal display which are not conspicuous and carry out a defect pixel.

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MEANS

[Means for Solving the Problem] In order to solve the trouble of the conventional technique mentioned above and to attain the above-mentioned purpose, it is the defect pixel amendment approach of a liquid crystal display of having the orientation film which arranges the direction of orientation of a liquid-crystal molecule, and to said orientation film, laser light is irradiated at the defect pixel part, an orientation function is reduced, and it is characterized by the defect pixel amendment approach of the liquid crystal display of this invention by to amend the outgoing-radiation quantity of light to the amount of predetermined incident light of a defect pixel. Thereby, the light transmittance of a defect pixel is fixable to arbitration within the change width of face of the light transmittance of a surrounding normal pixel, it cannot be conspicuous and a defect pixel can be carried out.
[0008] In order to amend light transmittance with a sufficient controllability, it is good to perform this amendment before arrangement of a polarizing plate. Namely, on the other hand, as for said liquid crystal display, said orientation film is formed in a field side in this case. It has two substrates with which the polarizing plate which makes only the light of the predetermined direction penetrate has been arranged at the another side side side. The exposure of said laser light On the other hand, oppose a field side mutually, and said two substrates are made to counter, and after [which enclosed liquid crystal with the gap] the orientation film is formed, it is characterized [other] by carrying out, before arranging said polarizing plate to the another side side side of each substrate.
[0009] Moreover, a controllability rises and is more desirable [an exposure], when a laser beam exposure repeats light transmittance measurement and a laser light exposure and they are performed until it performs it, carrying out the monitor of the light transmittance and it reaches predetermined target light transmittance. Although the exposure of laser light may change the energy density and beam diameter of a laser beam, since laser radiation is stable and 1 time of exposure energy is also small when multiple times and laser light are irradiated extracting a beam diameter and shifting an exposure location within a defect pixel part, the further improvement in a controllability is possible for it. Moreover, since the control should just shift a relative position, it is easy in comparison.
[0010] Predetermined light transmittance is better than a mean value with that of the light transmittance at the time of the black display of a normal pixel, and the light transmittance at the time of a white display to set to a black display side. It is because a defect pixel is not conspicuous as a whole and is desirable in this semantics, when the light transmittance of a defect pixel is amended to the black side, since the luminescent-spot defect pixel with light transmittance high 1 pixel is conspicuous from that reverse ******** pixel while the perimeter is indicating by black.
[0011] On the other hand, in the defect pixel compensator of the liquid crystal display of this invention The light source which applies light to the defect pixel to the liquid crystal display which has the orientation film which arranges the direction of orientation of a liquid crystal molecule, A light-receiving means to receive the outgoing radiation light from a defect pixel which received the light from the light source, A measurement means to measure the outgoing radiation quantity of light to the amount of predetermined incident light of a defect pixel based on the light income of a light-receiving means, It is characterized by having the control means which sets up the exposure conditions of laser so that the

light of said predetermined outgoing radiation quantity of light may be outputted from a defect pixel, and a laser radiation means to irradiate laser light and to reduce an orientation function on the orientation film of a defect pixel based on said exposure conditions. moreover, the inside of said defect pixel -- the exposure location of laser light -- specified quantity ****** -- a variation rate -- a means can also be made to provide further in this case -- said exposure conditions -- the variation rate concerned -- the variation rate of the exposure location of the laser light by the means -- an amount and a variation rate -- a direction and a variation rate -- a count is contained.

[0012]

[Embodiment of the Invention] In advance of explanation of the pixel compensator of the liquid crystal display concerning this invention, and the pixel amendment approach, the configuration of the liquid crystal display with which this invention is applied is explained hereafter, referring to a drawing. The liquid crystal display (liquid crystal panel) with which this invention is applied can be carried out especially suitable for matrix means of displaying with many pixels, although there is especially no limitation. ** whose drive method is also an active-matrix drive method as it is a simple matrix drive method is not asked. Moreover, reliance is also good at any of a reflective mold and a transparency mold.

[0013] Hereafter, the case where a driver element is a thin film transistor (TFT;Thin Film Transistor) is explained to an example as an example of an active-matrix drive method. The rough configuration of a liquid crystal panel is shown in drawing 1 and 2, drawing 1 is structural drawing of the 1-pixel part of a liquid crystal panel, and drawing 2 is a representative circuit schematic. As shown in drawing 1 , in this liquid crystal panel 2, generally, two substrates 4 and 6 are made to counter, liquid crystal is enclosed with that gap, and the liquid crystal layer 8 is formed.

[0014] As these two substrates, although single crystal silicon is sufficient in reflective molds, such as a MOS-FET mold, in order to make the light from a back light penetrate, the quartz-glass substrate with a thickness of about 0.8-1.1mm etc. is used in this TFT mold. Here, the substrate 4 of the drawing bottom (back light side) is called a drive substrate, and the substrate 6 of a drawing top (panel front-face side) is called an opposite substrate.

[0015] The signal line S1 with which a picture signal is impressed to the liquid crystal side front face of the drive substrate 4 as shown in drawing 2 , and S2 -- and Sn, The gate line G1 by which a scan signal is impressed, and G2, --, Gm are arranged in the shape of a matrix, and the thin film transistor (it is written as "Trij" the nMOS transistors Tr11, Tr12, Tr21, and Tr22, --, Trnm, and the following) is prepared near [each] the intersection. For each nMOS transistor Trij, the gate is connected for any of the gate line G1, and G2, --, Gm being, and one impurity diffused layer is a signal line S1 and S2. It connects with any of -- and Sn.

[0016] On this nMOS transistor Trij, the transparent pixel electrode 10 divided for every pixel as shown in drawing 1 is formed, and the orientation film 12 for arranging the direction of molecular arrangement of the liquid crystal layer 8 is formed on it. The pixel electrode 10 consists of transparent electric conduction film, such as ITO (Indium Tin Oxide). Although there is no limitation in the thickness, it is about 140nm, for example. As orientation film 12, although the inorganic film is sufficient, organic film, such as polyimide film which has about dozens of nm thickness, is usually used. On the other hand, as for the front face of the orientation film 12, rubbing processing is performed to the direction (drawing longitudinal direction).

[0017] On the other hand, although not illustrated especially in the liquid crystal side front face by the side of the opposite substrate 6, a black stripe is arranged on both sides and a color filter is formed, and as shown in drawing 1 , the transparent common electrode 14 which consists of ITO film etc. is formed, and it is covered with the liquid crystal side face by the orientation film 16. Although rubbing processing is performed also for the front face of this orientation film 16, that direction lies at right angles 90 degrees in the orientation film 12 by the side of the drive substrate 4. Thereby, the condition that the direction of molecular arrangement was twisted 90 degrees in the thickness direction is prepared like illustration in the liquid crystal layer 8. In addition, the thickness of the liquid crystal layer 8 is about several micrometers.

[0018] The capacitor is constituted on both sides of the liquid crystal layer 8 by the common electrode 14 and the above mentioned pixel electrode 10. On the equal circuit of drawing 2 , Capacitors C11, C12, C21, C22, --, Cnm and liquid crystal are connected to juxtaposition at one impurity diffused layer of each nMOS transistor Trij, respectively. The common electrode 14 is the common potential Vcom. It is held.

[0019] Polarizing plates 18 and 20 are stuck on the lateral surface of the drive substrate 4 and the opposite substrate 6, respectively. Each polarizing plates 18 and 20 are arranged after the light absorption shaft has intersected perpendicularly mutually.

[0020] If back light light is applied to the liquid crystal panel 2 of such a configuration from the outside of the drive substrate 4, on the other hand, the light will polarize in a direction through a polarizing plate 18, will penetrate the drive substrate 4 and the pixel electrode 10 further, and will carry out incidence to the liquid crystal layer 8. While light penetrates the inside of the liquid crystal layer 8, the polarization direction of the transmitted light meets in the direction of molecular arrangement of liquid crystal according to the effectiveness of the optical anisotropy of a liquid crystal molecule, it changes 90 degrees, the common electrode 14 and the opposite substrate 6 are passed, and incidence is carried out to a polarizing plate 20. Since said polarizing plate 18 and polarization direction which light penetrated first lie at right angles 90 degrees as this polarizing plate 20 was described above, as for the light which carried out incidence to the polarizing plate 20, in accordance with the polarization direction of a polarizing plate 20, outgoing radiation of most is carried out for that polarization direction to a panel front-face side. Therefore, a pixel front face is checked by looking by back light light as a bright condition, and a white display is made.

[0021] At the time of the above white display, the electrical potential difference is not impressed between the pixel electrode 12 and the common electrode 14. On the other hand, the direction of molecular arrangement of the liquid crystal layer 8 will come to be equal to a lengthwise direction according to that applied voltage, if an electrical potential difference is impressed to these two electrodes 12 and 14 gradually in accordance with electric field. Drawing 3 shows the case where an electrical potential difference is fully made high. In this case, since the polarization direction of the light which passes through the inside of the liquid crystal layer 8 hardly changes, to a panel front-face side, light hardly penetrates, but it is checked by looking as a condition dark in a pixel front face, and a black display is made.

[0022] Drawing 4 shows the permeability property which light transmittance decreases with the increment in driver voltage. As shown also in this property Fig., by adjusting applied voltage in such a liquid crystal panel 2, middle gradation of the above-mentioned white display and a black display can be realized, and color display is possible according to a non-illustrated color filter. This voltage adjustment is a signal line S1 and S2, in case each gate line G1, and G2, --, Gm are chosen in drawing 2 according to a scan signal. --, and potential and common potential Vcom of a picture signal which were impressed to Sn It is decided by the potential difference (driver voltage).

[0023] The case where the liquid crystal panel 2 mentioned above is used next about the defect pixel compensator and the defect pixel amendment approach of this invention is explained to a detail, referring to a drawing for an example. This invention amends the light transmittance of a defect pixel etc. by reducing the orientation function of the orientation film 12 and 16 of drawing 1 .

[0024] First, the defect pixel is explained briefly. Drawing 5 is drawing showing typically the drive substrate 4 above child in whom the pixel electrode 10 was formed, and makes the A section of drawing 2 repeat and arrange. In the manufacture process of a liquid crystal panel 2, a defect pixel may occur according to dust, a mask pattern defect, etc. As Sign B shows drawing 5 to one of the failure mode of this, the wiring layer between the pixel electrode 10 and the nMOS transistor Trij (or wiring layer between signal lines Si and Trij) may go out (henceforth pattern defect B). Moreover, it may remain wide opened as other failure modes, while abnormalities are in the nMOS transistor Trij itself and the channel had short-circuited as Sign C shows to this drawing (henceforth a transistor defect).

[0025] A defect pixel with it is called especially a luminescent-spot defect pixel, without building an electrical potential difference over failure mode of abbreviation being in a circumference pixel by

carrying out in a pattern open circuit, channel disconnection of a transistor, etc., and the predetermined electrical potential difference being impressed only there. [high light transmittance and] [bright] Moreover, an electrical potential difference is built over the electrical potential difference not being impressed to a circumference pixel for failure mode in a channel short circuit etc. only there, and a defect pixel with it is called especially a ******** pixel. [low light transmittance and] [dark]

[0026] Among these, since the luminescent-spot defect pixel in the inside as for which the perimeter is indicating by black is conspicuous from the ******** pixel in the inside currently white-displayed, below, this invention is explained to an example for the case of a luminescent-spot defect pixel. Drawing 6 is the outline block diagram of the defect pixel compensator of this invention. This defect pixel compensator 30 consists of the camera 36 which changes into an electrical signal the image of the microscope 34 for extracting the beam of the laser head 32 which generates laser light, and laser light, and observing a liquid crystal panel 2, and a microscope 34, a xy stage 38 which supports and carries out alignment of the liquid crystal panel 2, an image processing system 42 which measures the light transmittance of the 40 pixel back light light source, and a controller 44 which controls laser head 32 grade based on light transmittance.

[0027] Below, the concrete procedure of defective amendment is explained along with the flow chart of drawing 7 . First, the liquid crystal panel 2 as a candidate for defective amendment is put on the xy stage 38, and the address of the defect pixel of a liquid crystal panel 2 is inputted into a controller 44 (ST1). A manual entry is sufficient as this address input, and you may make it incorporate a controller 44 automatically from the test equipment whose address is not illustrated.

[0028] According to the address of the inputted defect pixel, a controller 44 controls the xy stage 38 and moves a defect pixel into the visual field of a camera 36 (ST2). And the back light light source 40 is turned on with directions of a controller 44, the amount of transmitted lights is changed into an electrical signal through a camera 36, and after measuring the light transmittance of a defect pixel with an image processing system 42 based on the amount of transmitted lights which this electrical signal shows, the optimal exposure conditions are computed and set up by the controller 44 based on a measurement result (ST3).

[0029] These optimal exposure conditions differ by into how much light transmittance of a defect pixel is made. Although the predetermined light transmittance made into this target may be set as what kind of value within the change width of face of a normal pixel, it is better than a mean value with the time of the black display of a normal pixel, and a white display preferably to set to a black display side. It is because a defect will stop being able to be conspicuous easily as a whole if the light transmittance of a defect pixel is amended to the black side since the luminescent-spot defect pixel with light transmittance high 1 pixel is conspicuous from the reverse ******** pixel while the perimeter is indicating by black as stated previously.

[0030] After adjusting so that a controller 44 may control the optical system of a microscope 34 and a laser beam may become the orientation film 12 of a liquid crystal panel 2, or a beam diameter (or energy density) predetermined by 16 while a controller 44 adjusts the output of a laser head 32 according to the set-up exposure conditions, laser light is irradiated at a defect pixel (ST4). The exposure of this laser light is performed two or more times within the defect pixel with this operation gestalt, shifting an exposure location at a minute step, although predetermined target light transmittance may be once aimed at by exposure. In this case, the amount of displacement, the displacement direction, and the count of displacement of this minute step are contained in the exposure conditions which a controller 44 sets up by the above ST 3. Moreover, the controller 44 at this time controls a laser head 32 and a microscope 34, and also moves the xy stage 38 at a minute step.

[0031] Damage section 12a is introduced into the orientation film 12 by the exposure of this laser light, the orientation function of the orientation film 12 falls by this, and drawing 8 shows signs that the direction of orientation is disturbed. Moreover, drawing 9 is an explanatory view in which this invention persons show the situation of the cross section when actually introducing damage section 12a into the orientation film 12 using this invention. By drawing 9 , a hole opens on the orientation film 12, the orientation film 12 has been turned over to that perimeter, and the bottom of the exposure conditions in

this example can be asked about signs that a liquid crystal molecule is perpendicularly located in a line along with this. Die length of one side of the pixel used for this example is about 50 micrometers, and since the outer diameter of the damage section by laser light exposure is about 2 micrometers, the light transmittance of a pixel is changeable at a quite fine step.

[0032] In ST5 of drawing 7 , the light transmittance of a defect pixel is again measured after the exposure of laser light, and it judges whether target light transmittance is attained by following ST6. When the failure mode of a defect pixel is the open circuit by the pattern defect, drawing 10 is before and after the exposure of laser light, and is the permeability property Fig. showing the situation of change of light transmittance. Since the light transmittance in this defect pixel does not require driver voltage, constant value is shown. When this value is made into 100%, light transmittance is reduced to 15% of desired value by laser light exposure.

[0033] When target light transmittance is attained by the judgment of ST6 of drawing 7 , the defective amendment concerned is completed. When this is not attained, a controller 44 computes exposure conditions again (ST7), returns a flow before ST4, and irradiates laser light again. ST4-ST7 are repeated until target light transmittance is attained.

[Translation done.]

DOCUMENT 1/1

DOCUMENT NUMBER

@: unavailable

1. JP,10-062734,A(1998)

JAPANESE [JP,10-062734,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

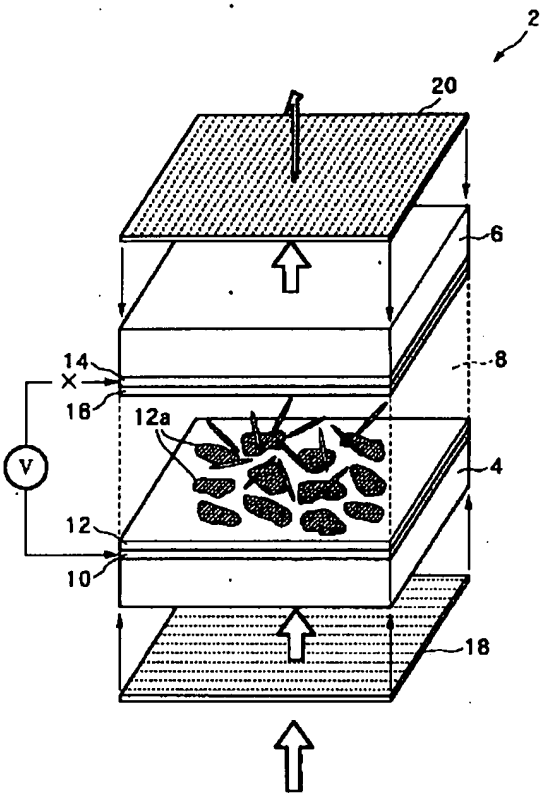
* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing 1 is structural drawing of a 1-pixel part showing the outline configuration of the liquid crystal display concerning the operation gestalt of this invention.
[Drawing 2] Drawing 2 is the representative circuit schematic of this liquid crystal display.
[Drawing 3] Drawing 3 is structural drawing of the liquid crystal display in which the case where an electrical potential difference high enough is impressed is shown to inter-electrode [of this liquid crystal display].
[Drawing 4] Drawing 4 is the permeability property Fig. showing signs that light transmittance declines with the increment in driver voltage.
[Drawing 5] Drawing 5 is drawing showing typically the drive substrate above child in whom the pixel electrode was formed, in order to show the failure mode of a defect pixel.
[Drawing 6] Drawing 6 is the outline block diagram of the defect pixel compensator concerning the operation gestalt of this invention.
[Drawing 7] Drawing 7 is a flow chart which shows the procedure of the defect pixel amendment approach concerning the operation gestalt of this invention.
[Drawing 8] Drawing 8 is structural drawing of the liquid crystal display in which signs that the damage section was introduced into the orientation film by the exposure of laser light are shown.
[Drawing 9] Drawing 9 is the explanatory view showing the situation of a cross section when this invention persons make the damage section actually introduce into the orientation film using this invention.
[Drawing 10] Drawing 10 is the permeability property Fig. in which being before and after the exposure of laser light, and showing the situation of change of light transmittance, when the failure mode of a defect pixel is the open circuit by a pattern defect etc.
[Description of Notations]
2 -- A liquid crystal panel (liquid crystal display), 4 -- A drive substrate (substrate), 6 -- Opposite substrate (substrate), 8 [-- Damage section,] -- A liquid crystal layer, 10 -- 12 A pixel electrode, 16 -- The orientation film, 12a 14 [-- Laser head (laser Mitsuteru gunner stage),] -- 18 A common electrode, 20 -- A polarizing plate, 30 -- A defect pixel compensator, 32 34 -- A microscope, 36 -- A camera (light-receiving means), 38 -- xy stage (variation rate means), 40 -- The back light light source (light source), 42 -- Image processing system (measurement means), 44 [-- A thin film transistor, a nMOS transistor, G1 -Gm / -- A gate line, S1 - Sn / -- A signal line and Vcom / -- Common potential.] -- A controller (control means), C11 grade -- A capacitor, P11 grade -- A pixel, TR11 grade

[Translation done.]

Drawing selection Representative drawing



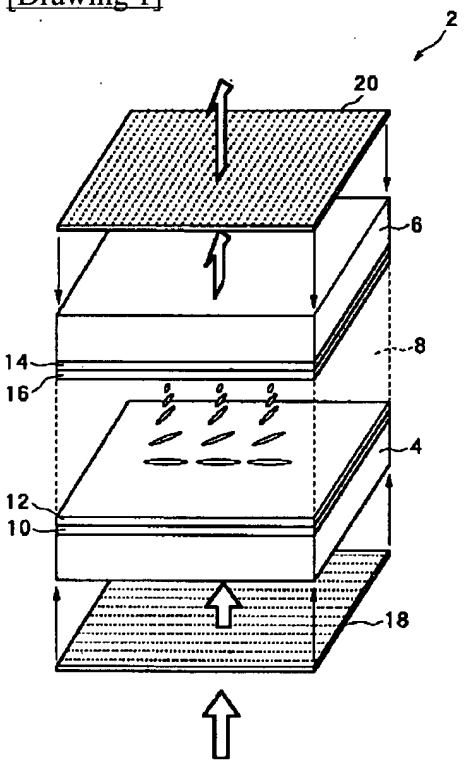
[Translation done.]

* NOTICES *

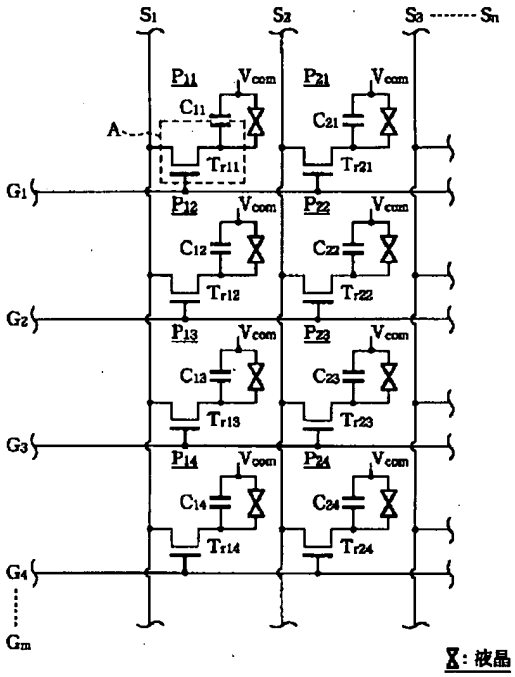
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

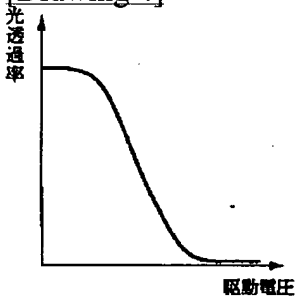
[Drawing 1]



[Drawing 2]

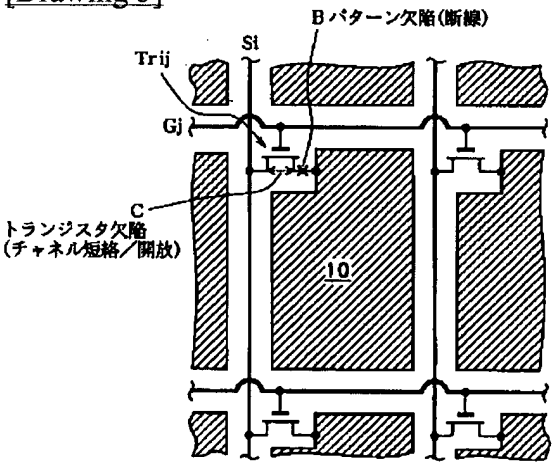


[Drawing 4]

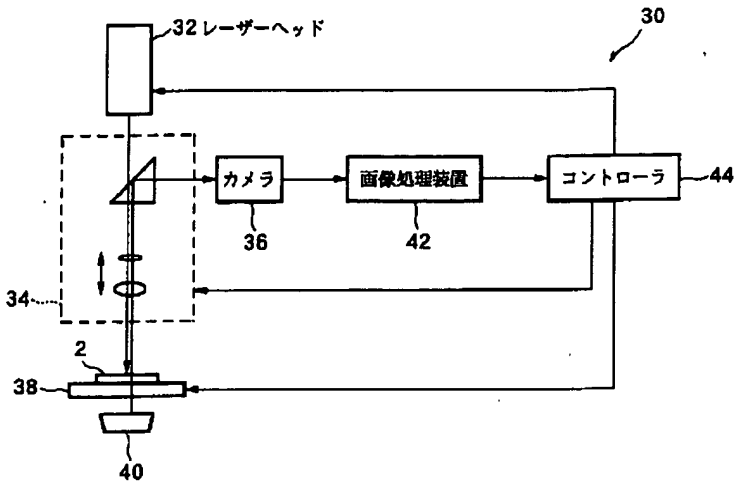


正常画素の透過率特性

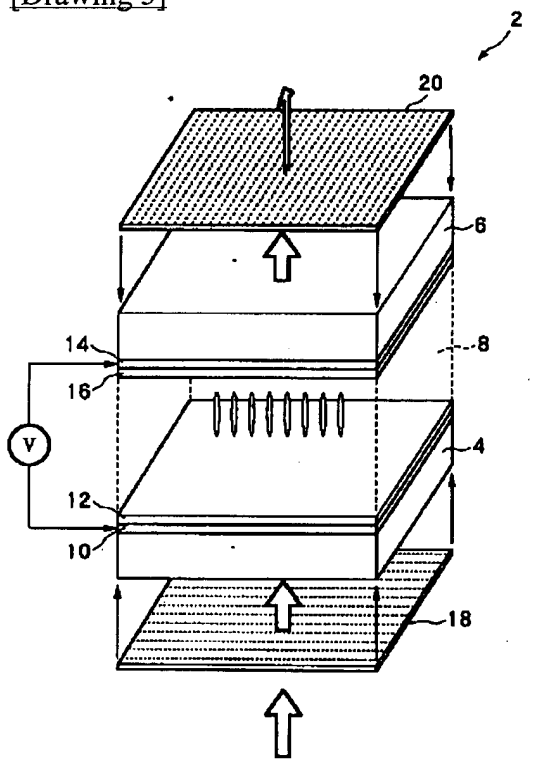
[Drawing 5]



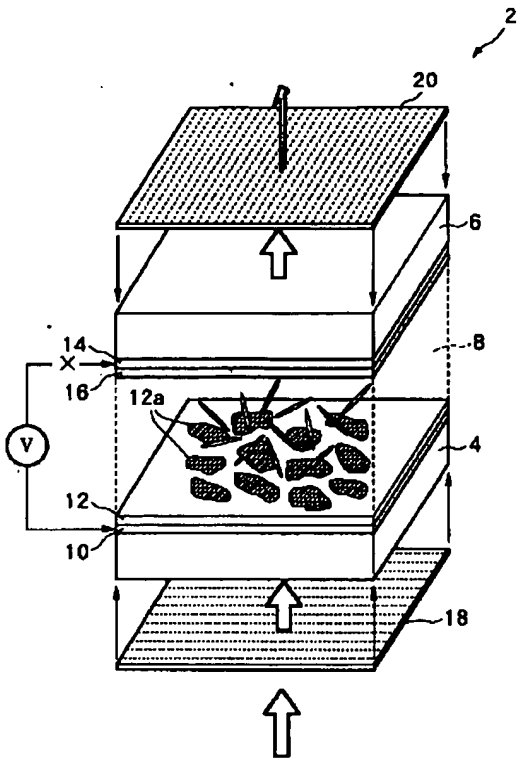
[Drawing 6]



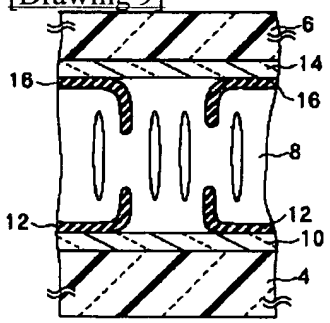
[Drawing 3]



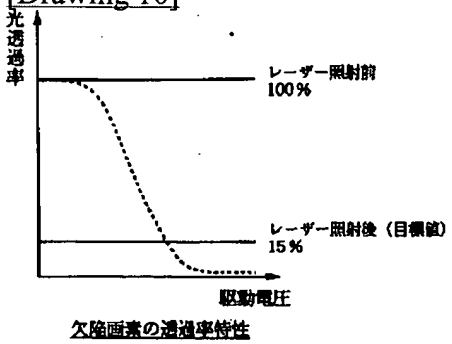
[Drawing 8]



[Drawing 9]

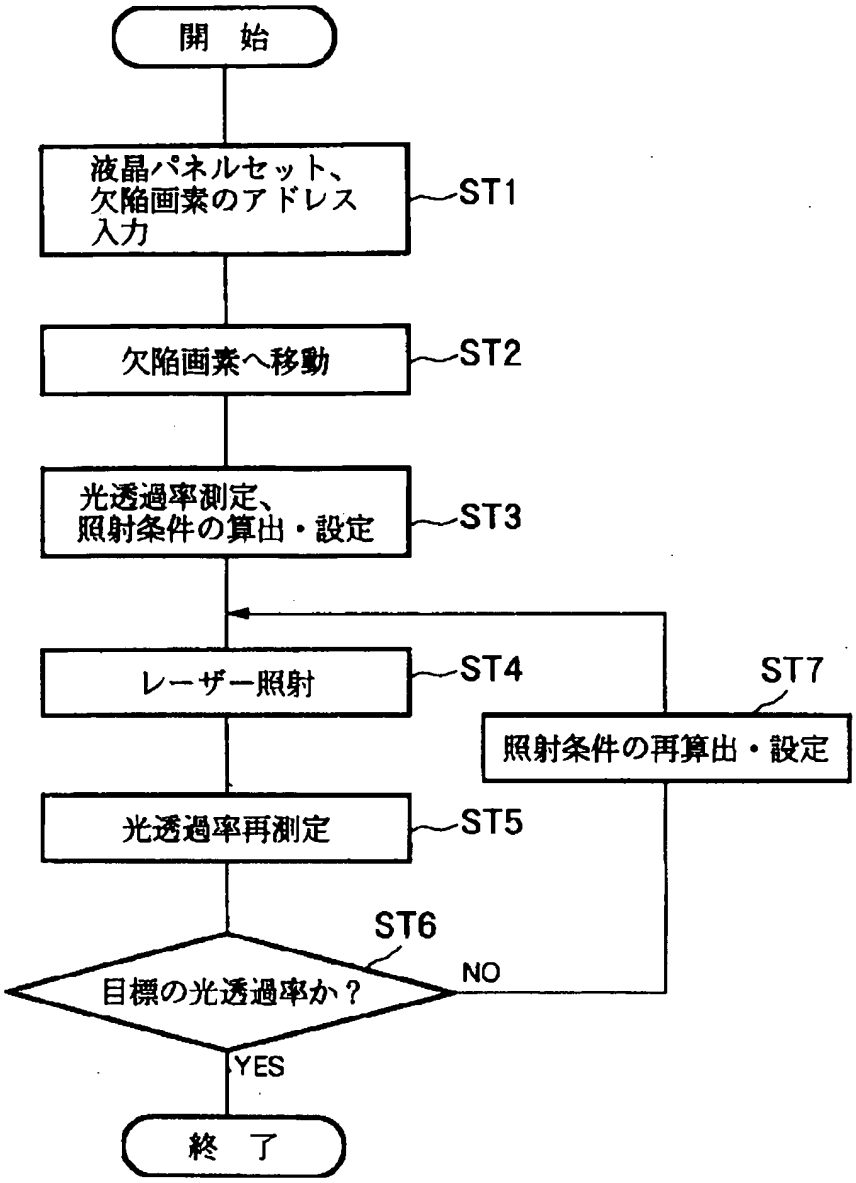


[Drawing 10]



欠陥画素の透過率特性

[Drawing 7]



[Translation done.]